

THE
TELEGRAPHIC JOURNAL
AND
ELECTRICAL REVIEW.

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THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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5	3-16 in.	23 in.	½ to 1	1 to 1½	1½ to 2	150 to 200	250 to 350	7 in. 2½ in.	1½ in.	2½ in.	600 to 1500	£15 os.
6	¼ in.	30 in.	1 to 2	2 to 3	3 to 4	300	500	9 in. 2½ in.	2 in.	3½ in.	400 to 1200	£25 os.
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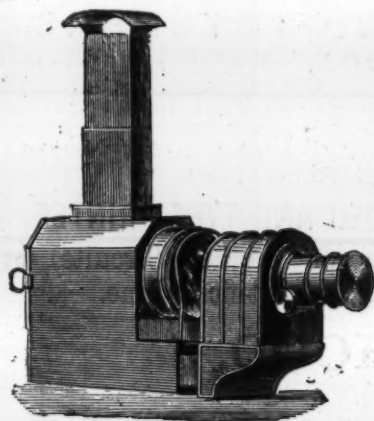
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(Signed) J. MAPLE & Co.

MIDLAND RAILWAY TELEGRAPH DEPARTMENT, Superintendent's Office, DERBY, 28th April, 1879.
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(Signed) W. LANGDON.
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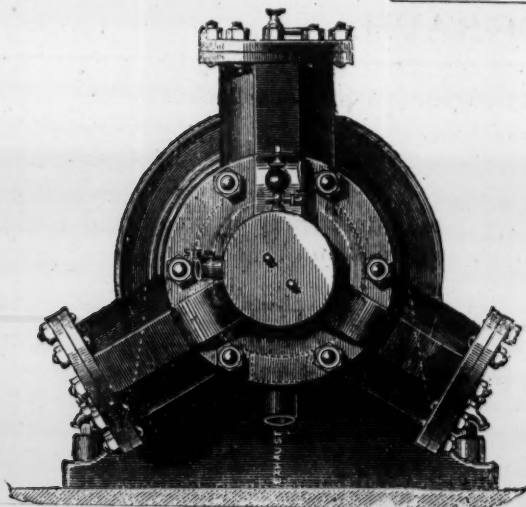
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THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. VII.—No. 156.

THE ELECTRIC LIGHT ON THE EMBANKMENT.

THE decision of the Metropolitan Board of Works to continue the use of the electric light on the Embankment for a period of six months longer, and to extend the Jablochkoff lamps over the Waterloo Bridge and up Northumberland Avenue to Trafalgar Square, is one of the most hopeful signs for the future of this means of illumination which have yet appeared. It speaks a vast deal more for the success of lighting by electricity than any sanguine criticism whatever, or even than those judicious telegrams which Mr. Edison chucks to a hungry and dissatisfied public, as a morsel of sweet sop to Cerberus. There has been a reaction against the electric light of late, and even scientific journals, which ought to have known better, have admitted into their pages articles treating of its utter "collapse." The best proof that there is no collapse of the electric light, is to be found in the steady, if slow, advance it is everywhere making. It is recognised now that great wonders are not to be accomplished all at once in electric lighting, even by the inventive wizard of Menlo Park; but, at the same time, it is put beyond a doubt, that this mode of illumination has securely established a footing, and is destined to develop by dint of continued improvement. The gratifying resolution of the Board of Works which we have recorded, is mainly due to a noteworthy progress which has been effected in the Jablochkoff mode of lighting employed on the Embankment. In the first place, frosted globes have been substituted for the opaline globes formerly used, and the practical result of this is to raise the luminous power of each lamp from 155 candles to 265, a gain, that is, of 70 per cent. The increased beauty and efficiency of the lamps is very remarkable. In the second place, it has been demonstrated that the high-pressure engine of 20 horse-power nominal employed is really capable of sustaining as many as 60 Jablochkoff candles ablaze. At present only 40 are utilised; but M. Berly, the engineer who has charge of the works of the Société Générale de l'Electricité, has recently set up 20 additional candles in the machinery shed at Charing Cross, and with these it is proposed to illuminate Waterloo Bridge on the one hand and Northumberland Avenue on the other. When this has been done, M. Goudet, the managing director of the French company in England, has undertaken to maintain the 60 lights

at 3d. per hour per lamp, the Board bearing the cost of installing the extra lamps and providing the two new Gramme dynamo-electric machines required for the latter.

In comparing this new scale of charge with the cost of gas, it turns out that, reckoning a 16-candle gas-jet at 3s. 6d. per 1,000 cubic feet, 3d. an hour, would only give us a gas-light equivalent to 230 candles; but the photometric power of each Jablochkoff candle, under the new frosted globes, is 265 candles, as determined by Mr. Keates, consulting chemist to the Board: therefore, the Jablochkoff light may now be said to have the advantage of gas, light for light. Further, the more electric lights there are required, the cheaper can they be supplied, as a limited experiment is more costly than a general introduction on a large scale would be. The importance of this achievement can hardly be exaggerated, when we consider the adverse reports which have been hitherto published, on the Jablochkoff mode of lighting on the Holborn Viaduct and at Westgate-on-Sea. It is a great matter to have reduced the expense of electric street-lighting to at least the same as that of gas; and, if electricians can only better this by making it practically cheaper than gas, they will reap a rich reward, for it is only the purse which argues in favour of gas-lighting.

OBACH'S PATENT TANGENT GALVANO-METER.

THIS galvanometer, which is manufactured by Messrs. Siemens Bros., is designed principally for the accurate measurement of the very powerful currents given by dynamo and magneto-electric machines, such as used for the electric light, for plating and depositing purposes, &c. In general appearance this instrument resembles an ordinary tangent galvanometer, but, unlike the latter, the ring through which the current passes is movable around its horizontal diameter lying in the meridian; the inclination of the ring to the horizontal plane is read off on a vertical scale. With a constant current strength, the force with which the magnetic needle in the centre of the ring is deflected from the meridian is proportional to the *sine* of the angle, which the plane of the ring encloses with the horizontal plane. Instead of measuring the angle between the ring and the horizontal plane, the angle which the ring makes with the vertical plane could also be taken, but in this case the *cosine* of the observed angle would be employed in place of the *sine*. In the instrument described the angle of the ring with the horizontal plane is read off, as the natural values of the *sine* are more frequently given in tables than those of the *cosine*, and can be used without further trouble.

Fig. 1 is a perspective view of the apparatus, showing the ring in an inclined position. From a base G, provided with three levelling screws, rises a stout brass column s; the bottom of this column is formed of a square block cut out at one side in the

shape of a Σ , and made strong enough to insure it against bending. The column can be turned on its axis in order to place the instrument in the magnetic meridian; the screw s' holds it firmly in its place. On the top of the column is a circular brass box N , about 8" in diameter and $1\frac{3}{8}$ " high.

each side of the opening, a semi-circular piece of gun-metal with clamp screws $k'k$ is fixed. On the inner face of the ring the opening is bridged over by a strong piece of ebonite H , in which a brass bush is inserted to hold the pivot on the end of the arm P' . The pivot on the arm P projects somewhat



FIG. 1.

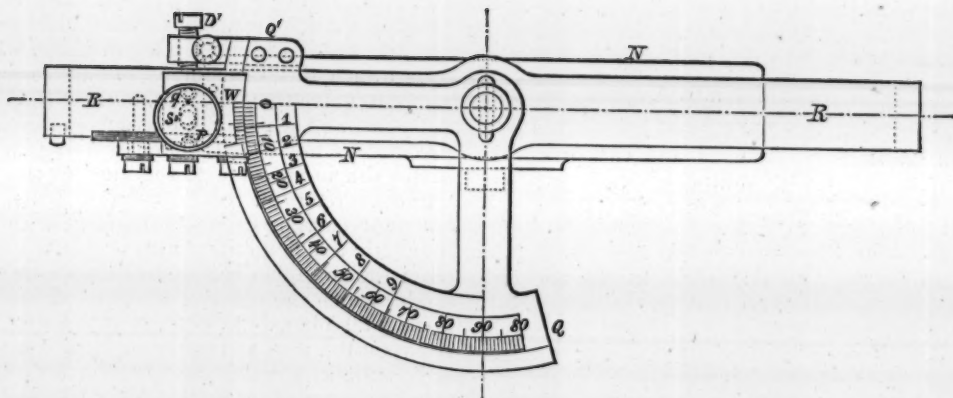


FIG. 2.

Conical arms P, P' are screwed to opposite sides of the box, and serve to support the ring R . This ring is made of gun-metal containing a high per centage of copper; the dimensions are $11\frac{3}{4}$ " inner diameter, about $\frac{3}{8}$ " thick, and 1" broad, so that the ring offers an exceedingly small resistance to the current. At a the ring is cut through; on the outer face, and at

beyond the ring R , and is insulated from it by an ebonite collar, over which is placed a brass collar for the ring to turn on. On this projecting pivot the quadrant Q, Q' , fig. 2, is placed, and held firmly by a pin. This quadrant is divided into degrees, and the angles, the sines of which (for radius = 1) correspond to the values 0.1, 0.2, 0.3 . . . 1.0, are

shewn on the same scale by longer marks. Fixed to the ring R, and insulated therefrom, is a brass arm carrying at its end a vernier w, which moves over the quadrant Q. The screw s" clamps both vernier and ring; the latter at its extreme vertical position is arrested by a screw D (fig. 1) in the lower part of the column and by another screw D' (figs. 1 and 2) when in the horizontal position. On loosening the screws q and p (fig. 2) the vernier can be shifted a little, so that when the zero adjustment of the ring is first made, the required agreement between the divisions on the vernier and quadrant can be obtained. This adjustment is made by sending as strong a current as possible in alternate directions through the ring, and then bringing the latter, by the alteration of the screw D', into such a position that no deflection of the needle takes place. When this is the case the vernier is set to zero. Within the circular box N (fig. 1), and at about half its height, is the circle T, divided into degrees of sufficient size to enable a tenth to be easily read. The length of the magnet is only $\frac{1}{15}$ the diameter of the ring; it carries an aluminium pointer, and is fixed to an axis, which is worked to a fine point at each end. On the circle T, in an exact line through the bearings of the ring, is screwed a light brass frame, having an agate bearing in the centre, and beneath it, in the middle of the box, is a second jewel or agate bearing. In these bearings the axis of the magnet plays. A screw underneath the brass box, acting on a brass spring, stops the movement of the needle. A small spirit level l is fixed in the box, so that the galvanometer may be accurately levelled. The current to be measured is led to the ring by means of two thick insulated copper wires L L' (fig. 1), which are wound together for a distance of about three feet, and connected to the clamp screws K K'.

Measurements with the galvanometer may be made in several ways: thus, by keeping the ring fixed, the tangents of the deflections represent the relative strengths of the currents producing those deflections, and this will be the case whether the plane of the ring be vertical or at an angle.

If the angle at which the ring is set be varied so as to produce the same deflection with currents of various strengths, then the relative values of the latter will be in the proportion of the cosecants of the angles at which the ring is set.

It may also be remarked that if different currents are measured with the ring at different inclinations, then the relative strengths of those currents will be proportional to the tangents of the deflections divided by the sines of the corresponding inclinations of the ring.

These theoretical results are completely verified by experiment.

To give an idea of the wide range of the instrument, it may be mentioned that it was possible to measure, without using any shunt, the powerful current developed by six dynamo-electric machines with their inductors connected up parallel, the whole of the electro-magnets being excited by a seventh machine. The resistance in the circuit was very small, being about the same as that of the parallel inductors.

When the ring of the galvanometer stands in the vertical position a current of 1 Weber deflects the needle about 13° at Woolwich.

ON HIGH ELECTRICAL RESISTANCES.

By J. HOPKINSON, F.R.S., D.Sc.

In the *Philosophical Magazine* of July, 1870, Mr. Phillips describes a method of readily constructing very high electrical resistances. A pencil-line is ruled on glass; the ends of the line are provided with the means of making electrical connexion; and the whole is varnished: by this means a resistance of two million ohms was obtained; and it was found to be constant under varying potential. This method of constructing resistances is alluded to in Maxwell's "Electricity" (p. 392); but I do not know that it has received the examination it deserves, or that it has come into general use. Having need of resistances of over 100 million ohms, I have made a few on Mr. Phillips's plan, ranging from 26,000 ohms to 96,000,000 ohms (which are fairly satisfactory), and one or two much greater (which do not conduct according to Ohm's law, but with a resistance diminishing as the electromotive force increases). A short description of these may perhaps save a little trouble to others who desire tolerably constant high resistances.

All my resistances are ruled on strips of patent plate glass which has been finished with fine emery, but has not been polished. The strips are twelve inches long, and, except in the cases specified belows about half an inch wide. One or more parallel lines are ruled on each strip, terminating at either end in a small area covered with graphite from the pencil. The strip of glass, first heated over a spirit-lamp, is varnished with shellac varnish, excepting only these small terminal areas, which are surrounded by a small cup of paraffin-wax to contain mercury to make the necessary connexions. To secure better insulation, feet of paraffin or of glass covered with paraffin are attached on the underside at the ends of the strip to support it from the table. Before varnishing, each strip was marked with a distinguishing letter. The strips marked g, h, i, a and b were ruled with a BB pencil, the remainder with a HHH.

These resistances appear to be not quite constant, but to vary slightly with time, the maximum variation in four months being slightly in excess of $\frac{1}{2}$ per cent. In every case they were examined under varying potential to ascertain if they obeyed Ohm's law. With the exception of f, described below, all were satisfactory in this respect. The resistance appears to diminish slightly as the temperature rises; but this conclusion rests on a single rough experiment, and must be regarded as uncertain.

The values of the resistances were determined with a differential galvanometer, each coil having a resistance of 3,500 ohms, by the well-known method of dividing a battery-current, passing one part through the large resistance to be measured and one coil of the galvanometer, the other through a set of coils or other known resistance, and then through the galvanometer shunted with a second set of resistance coils. g was thus compared with standard coils. g was then used to find h and i; and h + i was used to find a and b. A Thomson's quadrant electrometer was used to compare in succession k, l, and m with a + b. c and e were similarly

compared with $k + l + m$; and, lastly, c and e were used to examine f .

g is ruled on a strip one inch wide, rather more than half the surface being covered with graphite. Three experiments on the same day gave 26,477, 26,461, and 26,470 ohms; the variations are probably due to uncertainty in the temperature correction, the galvanometer-coils being of copper. After the lapse of four months 26,615 ohms was obtained.

i is ruled on a strip three quarters of an inch wide, with nine tolerably strong lines; its resistance was first found to be 209,907 ohms, and four months later to be 208,840.

h has four strong lines on a strip half an inch wide; resistance 207,954 on a first occasion, and 208,750 after the lapse of four months.

a has two lines narrower than the preceding; resistance 5,240,000 at first, and 5,220,800 after four months.

b has a single line apparently similar to either of those of a ; and the resistance is 9,168,000.

k , l , and m have each two lines ruled with a HHH pencil; their resistances are respectively 23,024,000, 14,400,000, and 13,218,000 ohms.

c and e also have two lines, but they are finer; the resistances are 79,407,000 and 96,270,000.

As already mentioned, all the preceding were tested with various battery-power, and were found to obey Ohm's law within the limits of observation. It was not so with f , as the following observation shows very clearly. c , k , e , and f were arranged as a Wheatstone's bridge. Junctions (f , c and e , k) were connected to the poles of a Daniell's battery varying from one to eighteen elements; junctions (e , f and k , c) were respectively connected through the reversing-key with the quadrants of the electrometer. The potential of one Daniell's element was represented by 270 divisions of the scale of the electrometer. Column I. gives the number of elements employed, II. the corresponding reading of the electrometer, III. the

value of $\frac{k}{k+c} - \frac{e}{f+e}$ deduced therefrom, and IV.

the values of the ratio resistance of f : resistance of e .

I.	II.	III.	IV.
1	16	0.060	5.1
2	25	0.046	4.6
3	31½	0.039	4.4
4	31	0.029	4.1
5	28	0.021	3.9
6	27½	0.017	3.8
9	10	0.0041	3.5
12	— 5	— 0.0016	3.4
15	— 25	— 0.006	3.3
18	— 47	— 0.0097	3.25

This result is by no means surprising. There is doubtless an exceedingly minute discontinuity in the fine line across which disruptive discharge occurs; and the moral is, that resistances of this kind should always be tested as regards their behaviour under varying electromotive force.

Several attempts to rule a line on a strip twelve inches long, with a resistance over 100,000,000 ohms, resulted in failure.—*Philosophical Magazine*.

EXAMINATION OF CERTAIN ALLOYS BY AID OF THE INDUCTION-BALANCE.

By W. CHANDLER ROBERTS, F.R.S., Chemist of the Mint.*

SOME weeks since, Prof. Hughes showed me that equal volumes of various metals give widely different indications with the induction-balance. It appeared probable that a careful examination of a definite series of alloys would prove to be of interest; and as Prof. Hughes at once gave me the most generous assistance, teaching me the manipulation and controlling the results, I am able to submit the following observations to the Society.

The relative values of different metals as indicated by the induction-balance were given by Prof. Hughes in a paper read before the Royal Society on the 15th of May last. They do not accord with the values usually accepted as representing the relative conductivity of the respective metals; and this being the case, it became important to ascertain what relation the indications given by alloys, when under the influence of the induced current, bear to their electric conductivities, which afforded Matthiessen a basis for dividing them into groups.†

A series typical of each group was therefore taken; the constituent metals were melted together in the requisite proportions; and the thoroughly mixed alloys were carefully rolled to a uniform thickness, usually 1.3 millim. Discs 24 millims. in diameter were then cut with the same punch; and these discs were placed in succession on one side of the balance, so that their bases lay exactly on a line midway between the primary and secondary coils, this having been found to be the plane of maximum force. The respective values of the alloys were ascertained either by introducing the sonometer into circuit, or by superposing a graduated wedge-shaped scale of zinc over the opposing coil of the balance, as has already been explained by Professor Hughes.

The alloys of Lead and Tin were selected as an example of Matthiessen's first group. The results are recorded in the following table, and are graphically indicated in the curve No. 1, plate vi. The readings are those of the zinc scale.‡

The Gold-Silver alloys, representing the second group, presented no difficulty of manipulation; and the observations were made on discs 1.3 millim. thick and 24 millims. in diameter. The results are given in the table and in curve No. II.

The alloys of Tin and Copper, taken as representative of the third group, are peculiar. Their tints and fractures are widely different; and the series is interesting as having various industrial applications. As many of them are too brittle to roll, a block of each alloy 18 millims. square by 7 millims. thick was formed with the file. The

* Read before the Physical Society.

† British Association Report, 1863, p. 37.

‡ The use of a scale of greater accuracy than the one employed may slightly alter some of the figures, but it can hardly change the general nature of the curves.

results are given in the table and on the curve No. III.

No.	Percentage composition.	Approximate formula.	Readings on Induction-balance.
TIN-LEAD.			
1.	100 (pure tin).		67.5
2.	77.37	Sn_6Pb	62.0
3.	69.60	Sn_5Pb	59.0
4.	53.20	Sn_3Pb	52.5
5.	36.30	Sn_2Pb	51.0
6.	23.30	SnPb_2	47.0
7.	12.50	SnPb_4	45.0
8.	8.60	SnPb_6	46.0
9.	0 (pure lead).		43.0
SILVER-GOLD.			
1.	100 (pure silver).		225
2.	99.97		209
3.	99.90		205
4.	99.50		192
5.	99.10		170
6.	98.02		148
7.	94.93		115
8.	90.00		84
9.	81.40	Ag_8Au	60
10.	68.70	Ag_4Au	48
11.	52.30	Ag_3Au	44.5
12.	35.50	AgAu	42.8
13.	21.50	AgAu_3	44
14.	12.00	AgAu_4	49
15.	8.30	AgAu_6	60
16.	4.1		90
17.	0 (pure gold).		150
COPPER-TIN.			
1.	100 (pure copper).		167
2.	89.00	SnCu_{15}	65
3.	84.33	SnCu_{10}	51
4.	79.02	SnCu_7	45
5.	72.91	SnCu_5	40
6.	68.28	SnCu_4	37
7.	65.00		49
8.	61.79	SnCu_3	83
9.	51.84	SnCu_2	73
10.	34.99	SnCu	73
11.	9.73	Sn_5Cu	82
12.	0 (pure tin).		85

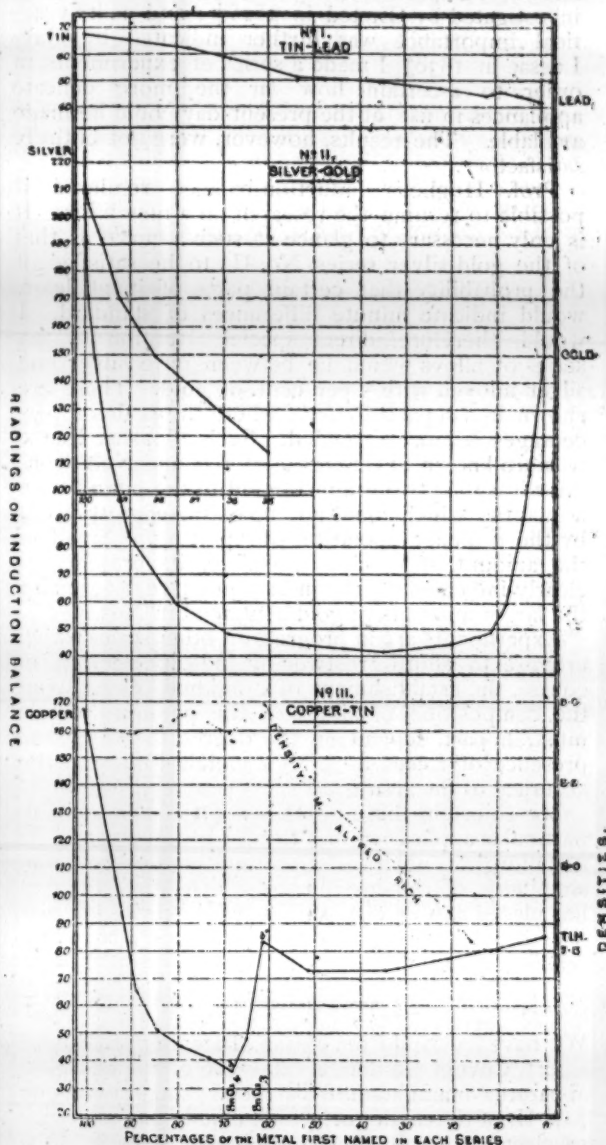
Note.—The Alloys were not annealed; and the temperature was about 15° C.

If the curves for lead-tin and gold-silver are compared with those given by Matthiessen* for the same alloys, their similarity will at once be evident. On the other hand, the induction-balance curve of the tin-copper series, while bearing some general resemblance to Matthiessen's curve of conductivity, differs essentially from it in certain parts. Matthiessen's curve falls rapidly from 93 (the conductivity of pure copper) to 9 (that of the alloy containing volumes per cent. of copper). It then passes horizontally in a line which is approximately straight to 13, the conductivity of tin.

Some light would appear to be thrown on the difference between the two curves by the work of M. Alfred Rich† on the density of alloys of copper and tin. He showed that copper and tin contract in alloying, the contraction being regular from pure tin up to the alloy containing 38 per cent. of tin, the density of which is higher than that of pure copper.

M. Rich's experiments were conducted on alloys both in the form of powder and ingots; the latter have alone been given in the curve marked with his name on the plate; and the relation between the two curves, especially at the points *a*, *a'*, *b*, *b'*, is too evident to need comment.

It may ultimately prove that if the alloys were rolled or compressed the curve would be modified; and, on the other hand, further experiments on the conductivity of the alloys may reveal points of



identity between the conductivity and induction-balance curves; the part where the former from being vertical becomes horizontal would be especially worth examination. It may be well to point out that the alloys SnCu_3 and SnCu_4 , which occupy critical positions on the induction curve, have been shown by M. Rich to be singularly free from the disturbing influence of liquation.

The work would appear to be interesting, as showing that the induction-balance may afford a simple means for detecting variations in the

* *Op. cit.* p. 46, and Watts's Dictionary of Chemistry, vol. iii. p. 943.
† *Ann. de Chimie et de Phys.* tome xxx. 1873.

molecular structure of alloys, and for indicating allotropy in metals with greater accuracy than has hitherto been possible.

Practical application.—The possibility of ascertaining the standard fineness of alloys, by the aid of electricity, long ago occupied the attention of physicists. In 1823 M. Becquerel^o suggested that trustworthy indications might be afforded by the electromotive force developed when the alloy is placed in an exciting fluid, together with an alloy of known composition. The subject was partially investigated by Ørsted in 1828†; and as its practical importance was further indicated by Gay-Lussac in 1830‡, I made a series of experiments in order to ascertain how far the more delicate appliances in use at the present day could be made available. The results, however, were not entirely satisfactory.

Prof. Hughes's induction-balance rendered it possible to resume the research on a new basis. It is only necessary to glance at such a curve as that of the gold-silver series, No. II., to be satisfied of the probability that certain parts of it, at least, would indicate minute differences of standard. I would, therefore, direct special attention to the series of alloys which lie between pure silver and silver alloyed with 5 per cent. of gold. These are shown in a separate curve, where the scale of percentages is more extended. Such alloys as Nos. 2 to 6 are known to refiners as doré; and No. 2 contains less than two grains of gold to the pound troy, a quantity which could not be extracted with profit by the ordinary operation of "parting." Small as the amount of precious metal is, its presence is clearly indicated on the induction curve, as are also the larger amounts of gold contained in Nos. 3-5.

Experiments are in progress on other series which promise to afford trustworthy indications; but, of course, the establishment of a method of verifying the composition of alloys of the precious metals must, in part, depend on the degree to which the presence of traces of foreign metals influence the accuracy of the results.

My object in these notes is not to insist on any particular application, but to bear testimony, from a metallurgical point of view, to the delicacy and simplicity of the instrument which Prof. Hughes has placed at our disposal; and I would offer him my sincere thanks for the liberal aid he has so readily given me.

WE have received from Messrs. Paterson of Bedford Court, Covent Garden, a catalogue of the electrical apparatus manufactured by them. In drawing up part II. of the catalogue, which chiefly has reference to electric signals, Messrs. Paterson have given a brief explanation of the principles on which electric signals for houses, mines, &c., work, and a few instructions for fixing the same, which renders the catalogue something more than a mere price list and make it a useful pamphlet for all who require to fix electric signals, but who have but little knowledge of the proper way to do so.

* *Ann. de Chimie et de Phys.* t. xxiv. 1823, p. 343.

† *Ibid.* t. xxxix. 1828, p. 274.

‡ *Instruction sur l'Essai des Matières d'Argent par la Voie Humide*, Paris, 1830.

THE TELEGRAPH IN NORWAY.

By P. TH. BOWITZ.

AMONG the nations of the earth Norway occupies but a subordinate position. Even with the modern facilities for rapid travel, measured in time, its distance from New York is about fourteen days.

Since regaining its independence in 1814, Norway has been exclusively engaged in the development of its home interests. Although its resources are limited as compared with most European countries, the advantages of modern improvements and inventions are appreciated and their benefits are earnestly sought to be secured for her. Among these the telegraph is recognised as one of the most important. The first telegraph line constructed in Norway was between the capital, Christiania, and Drammen. This was built in 1854, and was only four Norwegian (about 28 English) miles long. Now the net-work of lines extends all over the country. At the present time the Norwegian telegraph system includes 124 Government or public, and 103 railroad telegraph offices. The latter are employed mainly in railway service, and are not connected with the Government telegraph system.

The needle instrument is the apparatus most generally used upon the railroad lines, although at some stations the Morse register is employed. The operators in these railroad offices are boys and young girls. Their telegraphic knowledge and expertness is small, and their salaries are in proportion thereto.

Of the 124 offices comprised in the Government telegraph system, 16 are open only during the winter to accommodate the herring and codfish fisheries, and one (Oxoe, near Christiania), is merely a semaphore office. Christiania, the capital, is the only city in Norway that has more than one office, and in her case, for only a portion of the year. There, in addition to the central office, during the sessions of the Storting, or Norwegian Parliament, which, commencing February first, continues four or five months, a branch (Strothings) office is maintained.

Only in Christiania is there continuous day and night service, where it is necessary on account of the connection with the International telegraphic system. Of the other offices 7 are kept open from 7 or 8 o'clock, a.m. (according to the season), until midnight; 41 until 9 o'clock, p.m.; 53 to 1 o'clock, p.m., and from 3 to 9 o'clock, p.m.; and 5 offices have full day service during the fisheries season, about three winter months.

Norway is telegraphically connected with other countries by lines from Christiania and Trondhjem to Sweden, by submarine cables from Arendal to Denmark (Jutland), and from Egersund to Scotland.

The Morse register is principally used, although at a few of the offices, and upon the cable to Scotland, the Wheatstone apparatus is employed. At Christiania and Bergen duplex working has just been introduced.

A new apparatus invented by the Norwegian mechanic, Mr. Olsen, of a character similar to the Hughes, is being tried at Christiania. The use of the register is officially required, as the paper-tape is preserved for the sake of investigation of any errors that may occur. The majority of the operators, however, are able to receive by sound. Every office of course has its signature, as "C" for Christiania, "D" for Drammen, "Td" for Trondhjem, etc. The International alphabet is used, as on most European lines. After sending a message the sender gives his signature, and the number of the message, and a collation of the ciphers and the signature of the receiver are repeated back.

All the offices are well furnished, that of Christiania

splendidly, as it was formerly the mansion of one of the richest merchants of the city.

The Astronomical Observatory at Christiania has a line connecting it with the telegraph office, and twice a week, Sunday and Wednesday, is for a short time put in circuit with all the offices of the country, and the standard time is transmitted. The time at all offices is thus regulated to correspond with Christiania time.

Four hundred and fifty persons are employed in the telegraph service. Of these one is the director, one intendant, 11 are inspectors, with 264 male and 88 female operators. The salaries of the employés is fixed by the Strothing and is paid at the end of every month. The director submits to the Ministry of Postal and Naval affairs, in which department the telegraphs belong, a budget for the year, which includes everything connected with that branch of the service; and on this basis the estimates are submitted to the Strothing for its action thereon.

In the early years of the telegraph the pay of the employés was small, and those who competed for telegraphic employment were, some of them, possessed of but little learning. At present the salaries are better, and the requirements in reference to the knowledge and ability of candidates more strict.

It might interest the reader to know some of the salaries paid.

The Director receives about	1,930	dols
" Intendants	1,080	"
" Inspectors	870	"
" Managers	650	"
" Male Operators (second class)	320	"
" Female	250 to 350	"
" Pupils (ladies)	190	"

For managers, and for male and female operators who are not managers, there are some intermediate grades of payment. The salaries paid are not high, it is true, but, on the other hand, the country is not wealthy, and the cost of living is moderate.

Promotion of employés from a lower to a higher grade is based exclusively upon seniority in the service.

In the organization of the service, the director is the chief executive authority, subordinate only to the Postal and Naval Department. This position has been held from the first establishment of the system by the present director, Mr. Carsten F. Neilsen. This gentleman, who is much esteemed and loved by his subordinates, and who is a knight of several orders, was originally a lieutenant in the Royal Navy. When, in 1854, the establishment of the telegraph in this country was discussed, he furnished to the Strothing the plans and estimates therefor, and was appointed to superintend its construction and management, which duty was performed so efficiently and satisfactorily as to insure his retention in the position.

The intendant, Mr. Jonas Collett, has co-operated with his chief, Mr. Neilsen, from the first, and is a most efficient official. The inspectors are superintendents of a certain number of offices, and managers of the offices in the towns in which they reside.

Once or twice a year a school for pupils is opened at an office in a town where an inspector resides. The director advertises in the newspapers when and where the school will be held, how many pupils will be admitted, and the qualifications required of the applicants. The number of pupils admitted is usually 12 to 15. The qualifications requisite are that, if a man, the candidate must be from 17 to 25 years of age; if a female, from 20 to 25 years; must be in good health, which fact is testified to by a physician's certificate; must have passed at least an examination in a lower school (in such schools there is taught English, German, French or Latin, mathematics, history, geo-

graphy, physics, etc., etc.). It is essential that applicants for admission into the telegraphic service as operators shall understand the English, German, and French languages, and they must be of good character and reputation, which latter must be certified to by responsible parties. The successful applicants for admission into the school receive three months' instruction in a theoretical and practical course, under the direction of the inspector. The latter delivers a lecture of an hour's length daily to the pupils, who are also required to practice six hours daily. At the end of the course the inspector gives each pupil a certificate which specifies their order, exactness, diligence, and progress, and they are then appointed to fill vacancies as they occur.

A pension fund has been established to which all engaged in the telegraphic service are required to contribute, and to the benefits of which all are entitled. To this fund the men are required to contribute about two dollars and the women about one dollar per month. When retired from the service on account of disability or old age, each employé is entitled to a pension from this fund.

The male operators have, besides, a voluntary pension fund, through which the widows of deceased members are provided for. To this fund they contribute $1\frac{1}{2}$ per cent. of their monthly salary. Hitherto the widows entitled to the benefit of this fund have received *yearly* an amount equal to the entire amount contributed thereto by their deceased husbands. It has been possible to pay this high pension, as the operators enter the service at an early age, and generally remain unmarried for several years.

The male and female operators work in the same office, and as they are gentlemen and ladies the effect of their association has proved beneficial and elevating to the tone of the profession. Occasionally such business association results in a more intimate relation being established for life. In one case only are both of a married couple in telegraphic service. The lady operators are all highly educated, and belong to families of distinction. The men employed as operators are most of them graduates from the Royal University, and some of them have other subordinate employment, such as assistants in offices of advocates, banks, or as teachers, editors, &c. In a few instances the telegraph and post offices are combined. Two of the operators are Strothingsmand (Members of the Parliament), which consists of 111 members.

A telegraphic situation was for some years not particularly aspired to, but since the salaries have been raised, the youths have grown to men, the intellectual standard has been elevated and made more uniform, and the service has become an object of public consideration and aspiration.

The telegraph service has been of great importance to the industrial emancipation of females. The first employment of ladies in the service was in 1859. Two sisters, the Misses Breda, paved the way. Previously women were not employed in any public position, now they are found as clerks in the offices of the Ministry, counting-house offices, teachers in public schools, &c. Their admittance in the telegraphic service gave the first shock to the prejudice against their employment with their brethren in public positions; and women are not yet admitted to the privileges of the university.

Operators employed in the day service are on duty from 2 to 9 o'clock p.m., and from 7 or 8 o'clock a.m. to 2 o'clock p.m. the next day. They are then free from duty until 2 o'clock p.m. the following day. In some cases, however, when the operator engaged in the day service has other employment, a special arrangement is made so that their service is only required in the forenoon or afternoon.

This is, in brief, the situation of the telegraphs and telegraphers in this little country. We do not flatter ourselves that we can teach much to the telegraphers of a country where the electro-magnetic telegraph was invented, and has been so highly developed. It would, however, give us pleasure to know that a little interest is felt, by our telegraphic brothers and sisters in America, in such distant members of the fraternity.—*Journal of the Telegraph.*

A METHOD OF ADJUSTING GALVANO-METER SHUNTS.

By H. R. KEMPE.

THE accurate adjustment of the ordinary $\frac{1}{10}$ th, $\frac{1}{100}$ th, and $\frac{1}{1000}$ th shunts for galvanometers is often a somewhat troublesome operation, in consequence of the numerical values of the resistances of which these shunts are composed not being whole numbers; thus, supposing the resistance of the galvanometer to be 5,000 ohms, then the resistance of the $\frac{1}{10}$ th shunt would have to be $5,000 \div 9$ or 555.56; and, practically, this could not be adjusted to a greater degree of accuracy than one decimal place. Similarly, the $\frac{1}{100}$ th shunt should have a resistance of $5,000 \div 99$ or 50.505, and the $\frac{1}{1000}$ th shunt a resistance of $5,000 \div 999$ or 5.005, both of which numbers are somewhat awkward to adjust exactly. The following method of facilitating the operation I have found to be extremely convenient, and it is, as far as I am aware, novel.

Supposing the resistance of the galvanometer to be G , then the resistance of the shunt necessary to reduce the sensitiveness of the galvanometer $\frac{1}{n}$ th

should be, as is well known, $\frac{G}{n-1}$. Now, when the shunt is connected to the galvanometer-coil the combined resistance of the two will be

$$\frac{G \times \frac{G}{n-1}}{G + \frac{G}{n-1}} = G \times \frac{\frac{1}{n-1}}{\frac{n}{n-1}} = \frac{G}{n};$$

consequently to adjust the $\frac{1}{10}$ th shunt we may connect it to its galvanometer coil and adjust it until the combined resistance of the two becomes equal to $5,000 \div 10$ or 500 ohms. Similarly the $\frac{1}{100}$ th shunt would be adjusted by connecting it to the galvanometer coil and adjusting it till the combined resistance was found to be $5,000 \div 100$ or 50 ohms; also, we should adjust the $\frac{1}{1000}$ th shunt until the combined resistance was $5,000 \div 1,000$ or 5 ohms.

The great advantage of this method will be seen when the adjustments are made, as they would be, by the help of the ordinary Wheatstone bridge. Thus the resistance of the galvanometer-coil would be first obtained; using in the two "ratio" arms of the bridge the resistances 1,000 and 1,000; when balance is obtained by adjusting the plugs, the $\frac{1}{10}$ th shunt to be adjusted is connected to the galvanometer coil and the ratio in the bridge altered to 1,000 and 100, the other plugs not being touched. The shunt coil is then lengthened or shortened, as the case may be, until it is observed that the testing

galvanometer needle again stands at zero, when the shunt will be correctly adjusted. In a similar way the $\frac{1}{100}$ th shunt would be adjusted by obtaining balance with the ratio altered to 1,000 and 10, and the $\frac{1}{1000}$ th shunt with the ratio 10,000 to 10.

The advantage of this simple method will be found to be very great when practically tried, both as regards rapidity and accuracy of adjustment.

STEWART'S ELECTRIC LIGHT DISTRIBUTION SYSTEM.

THE object of this system is to enable the electricity generated by a dynamo-electric machine (or obtained from any other source) to be distributed through a number of circuits in succession in such a way as to permit of one, or as great a number of electric lights as may be required or found practicable, being established and maintained in each circuit by means of electric lamps. The principle of the system is as follows:—

A rapidly rotating arm, terminated by a spring contact, passes over and presses lightly upon a number of metallic contact pieces or pins insulated from each other and disposed at equal intervals around the face of a disc, and equal in number to the number of branch circuits in which the lights are to be produced in the district. The main wire or cable from the dynamo machine or other source of electricity at the central station, is in electrical connection with the arm of the commutator through its axis.

Now as a luminous object remains for about $\frac{1}{16}$ th of a second on the retina of the eye, it is evident that any object which is seen more than eight times in a second will appear to be constantly visible. If therefore the commutator arm rotates, say sixty or more times in a second, a current of electricity will be sent through each of the branch wires sixty or more times in a second, and if one or more suitable arrangements of carbons or other appliances for establishing the electric light be interposed in the circuit of each branch wire, the several lights will appear to be constant, notwithstanding that the flow of the current is intermittent, it being in fact interrupted at the rate of sixty or more times in a second.

Figure 1 shows a vertical section and figure 2 a plan of the rotating switch or commutator.

A is a horizontal disc of vulcanite, mounted on a stand, and B are metallic contact wires or strips of metal disposed radially on the disc at equal distances apart, and embedded in the face of the disc. To each contact B, a branch wire b is attached by binding screws, and in each circuit b are placed the electric light lamps. C is a spring contact in the form of a comb or brush, and attached to the extremity of a metal arm c , and so applied as to touch the contact wires B in succession when carried round by the revolution of a wheel or disc D, to the circumference of which said arm is attached. The disc or wheel D is of metal, and is firmly secured on a vertical steel spindle E, concentric with disc A, and its ends are coned and mounted to rotate between an upper bearing F and a metal footstep G. The foot e of the spindle E rests on a gate g in the footstep G, which is of cup form to contain mercury,

FIG. 1.

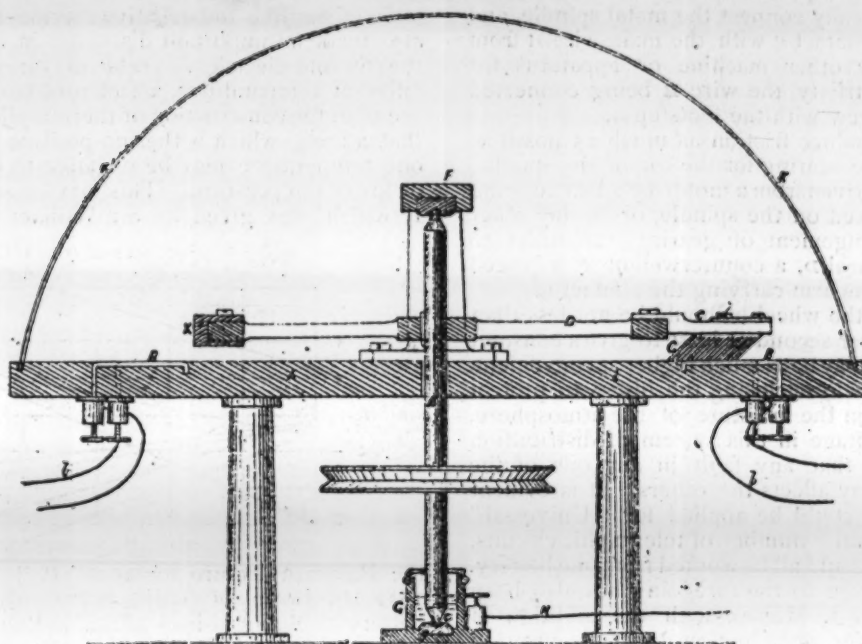
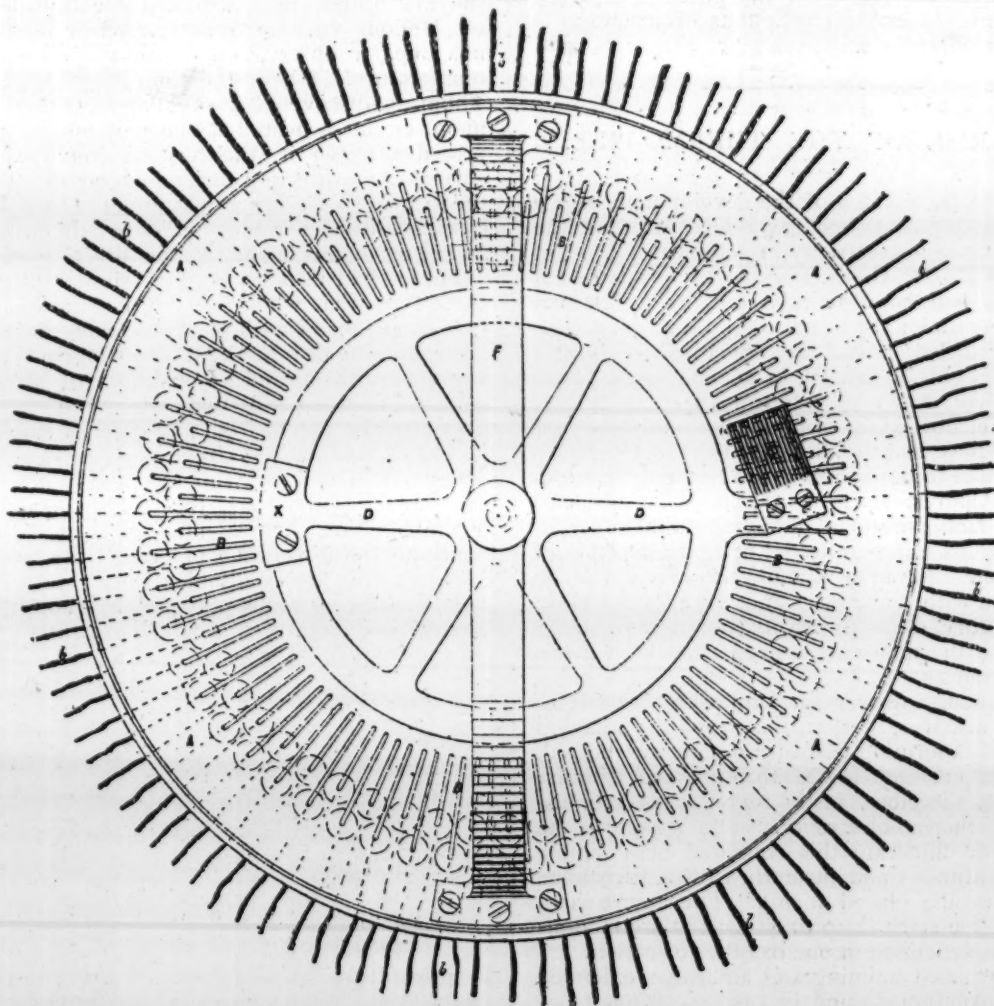


FIG. 2.



in which the foot of the spindle is immersed in order to electrically connect the metal spindle, and through it the contact *c* with the main wire *H* from the dynamo or other machine or apparatus for generating electricity, the wire *H* being connected by a binding screw with the footstep *G*.

In order to reduce friction as much as possible, there is an agate bearing for the top of the spindle, which latter is driven from a motor by a belt running on a pulley *I* fixed on the spindle, or by any other convenient arrangement of gearing. In order to balance the wheel *D*, a counterweight *x* is placed on it opposite the arm carrying the contact *c*.

The speed of the wheel *D* should be not less than 60 revolutions per second at least to give a constant steady light, but may be as much higher as convenient.

K is a glass shade enclosing the disc *A* to protect the contacts from the moisture of the atmosphere.

A great advantage in this system of distribution lies in the fact that any fault in any one of the circuits in no way affects the others. It is evident that the system could be applied for "Universal" battery working on a number of telegraphic circuits, so that the latter could all be worked from one battery.

A similar system to the foregoing has also been patented by Mr. J. Munro, with the addition of secondary batteries, or induction apparatus inserted in the lamp circuits to blend the portions of intermittent currents into a continuous stream, so as to obtain a steadier light.

THE RISE OF THE THERMO-PILE.

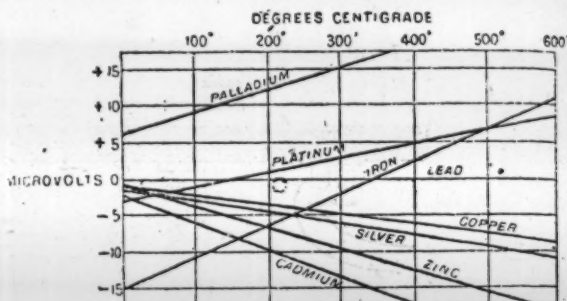
IN giving a short sketch of the development of the thermo-pile, we shall first say a few words on the history of thermo-electricity in general.

As early as 1707, the thermo-electric properties of tourmaline had been pointed out by a German writer, who, under the initials of J. G. S., published a book entitled "Curious Speculations During Sleepless Nights." Indeed, in ancient days, Theophrastus had shown that tourmaline, like amber, could be electrified by friction; but he does not appear to have had the idea that the electrification might be due to the *warming* produced by friction. In 1759, Alpinus, in Germany, called attention to the same fact, and pointed out that electricity of opposite kinds was manifested at opposite ends of the crystal. In 1760 Canton observed similar phenomena with the topaz; and, towards the close of the century, other observers, notably M. Haüy, showed the thermo-electric properties of various other substances.

It remained, however, for Professor Seebeck, of Berlin, to discover, in 1821, that when the junction of two metals forming part of a circuit was heated, an electric current flowed through the circuit; Seebeck is, therefore, justly regarded as the discoverer of thermo-electricity. The apparatus he employed to illustrate this consisted of a simple frame of antimony and bismuth, with a suspended magnetic needle placed within. The approach of the flame of a spirit lamp to either of the junctions produced a deflection in one or other direction.

Professor Jas. Cumming, of Cambridge, extended Seebeck's experiments, and, in 1823, ascertained that the unequal distribution of heat in the circuit was

the cause of thermo-electricity, and he drew up a table of positive and negative thermo-electrics. He also made an important discovery in what is called the thermo-electric *inversion* of various metals at different temperatures, a fact now constantly made use of in the construction of thermo-piles. It means that a metal which is thermo-positive to another at one temperature may be negative to it at a higher or lower temperature. This may be seen from fig. 1, which was given by Sir William Thomson, in



the Bakerian lecture for 1856 (Phil. Trans.). In 1832 Dr. Botto, of Turin, made a thermo-electric battery of platinum-iron pairs; and, in 1834, Nobili devised the compact form of arrangement known as the thermo-pile, an instrument which in the hands of Melloni became so wonderfully sensitive a machine for observation of minute differences of temperature. About the same time Sir William Thomson discovered a singular fact, that when a metal circuit is heated at one spot, and a current is passed through it, the heat is conveyed by the current in a direction dependent on the nature of the metal. With iron or platinum the heat is carried by the positive current from hot to cold, with copper and other metals in the reverse direction.

Peltier had also discovered a similar effect. His theory was, that, when a thermo current was formed in a circuit of bismuth and antimony, there was an absorption of heat at the surfaces of contact at the warmer junction, and an evolution of heat at the colder junction, and that the same result was obtained if a current from any exterior source were passed through such a circuit.

Sir Wm. Thomson, who thoroughly investigated the subject, pointed out that this explanation was incomplete, for, when a junction is at the neutral point, no Peltier effect can occur: the two metals being thermo-electrically identical.

The following table, prepared by Professor Tait, gives the temperatures at which certain metals are neutral to each other:—

Iron	-	-	-	-	-	+	357 °F.
Tin	-	-	-	-	-	+	45
Brass	-	-	-	-	-	+	27
Lead	-	-	-	-	-	-	—
Zinc	-	-	-	-	-	—	32
Copper	-	-	-	-	-	—	68
Cadmium	-	-	-	-	-	—	69
Aluminium	-	-	-	-	-	—	113
Silver	-	-	-	-	-	—	115
Palladium	-	-	-	-	-	—	181
German Silver	-	-	-	-	-	—	314

Professor Tait has also observed that the thermo-electric lines of the various metals, for varying temperatures, are approximately straight lines, a fact

which greatly simplifies the calculation of electro-motive forces for any desired combination.

In 1837 Dr. Andrews, of Belfast, found that fused salts could be employed as thermo-electrics, and constructed a battery with platinum wires, dipping into fused salts.

The first patent taken out in this country for a thermo-electric battery, was that of Moses Poole, in 1843. Poole used 100 pairs of German silver and iron rods, cemented in plaster of Paris; the lower ends were heated in a sand-bath, while a current of cold water was kept flowing over the upper ends. This battery was used for depositing metals.

In 1852 M. J. Roberts and C. Watt obtained patents, the former (among other things) for using hot air to excite the battery: the latter, for a combination of antimony and bismuth pairs.

We should also mention that, in 1847, Alexander Bain had employed a thermo-pile for regulating clocks, by means of a plate or lens, driven by train-work, and containing a slot through which the sun's rays passed at certain times of the day. In 1853 H. Krant employed the pile for thermometric measurements.

The first application (and perhaps the only one) of the thermo-pile to telegraphic use, was made by Mr. C. F. Varley, who, in a patent obtained in 1856, described a pile to be used in conjunction with induction coils, for telegraphing over short lines.

In 1862 Dr. Matthiessen read a paper before the Royal Society, in which he pointed out that some substances, such as silver, copper, and bismuth, have their conductivity increased by being heated for a considerable period, while others, such as tellurium, have their conductivity diminished by like treatment. Dr. Matthiessen had previously investigated this and kindred subjects most laboriously, and had drawn up the table given below—the first really accurate one published, most other experimenters having ignored the fact that, in measuring the electro-motive force of any pair of junctions produced by a given difference of temperature between the opposite junctions, the *mean* temperature of the circuit should be constant, or nearly so.

THERMO POSITIVE :—

		Silver and copper = 1.	Microvolts per degree Centigrade.
Galena	...	—	—
Bismuth	...	+ 24'96	+ 45 to 65
Mercury	...	+ 2'52	+ 4'18
Aluminium	...	+ 1'28	—
Lead wire	...	+ 1'02	—
Tin wire	...	+ 1'00	—
Copper	...	+ 1'00	—
Platinum	...	+ '72	—

THERMO NEGATIVE :—

Silver	...	—	—	3'0
Graphite	...	—	'05	—
Zinc	...	—	'21	—
Iron (piano wire)	...	—	5'20	17'5
Antimony	...	—	9'87	23 to 26
Antimony 2, Zinc 1	...	—	22'70	—
Tellurium	...	—	179'80	502
Selenium	...	—	290'00	807

The above table is extracted from Dr. Matthiessen's paper in the Philosophical Transactions for 1858.

Referring to the left-hand column of figures, it will be seen that he takes silver as his zero metal, and calling the effect of a silver-copper pair 1, he measures the electro-motive force of all the other couples by this standard, those above silver being considered thermo-positive metals, and those below it thermo-negative. The mean temperature was 19° to 20° C.

The right-hand column is a table calculated from this by Professor Jenkin, showing approximately the thermo-electric force of each couple in microvolts for each degree Centigrade. Professor Jenkin, however, takes lead as his zero instead of silver. The tensions above lead are, therefore, positive, and those below are negative, and to obtain the power of any positive and negative couple we must add the two together; thus bismuth and antimony have a force of 45 + 23 as compared with that of silver and copper, or a tension of 68 microvolts for each degree Centigrade.

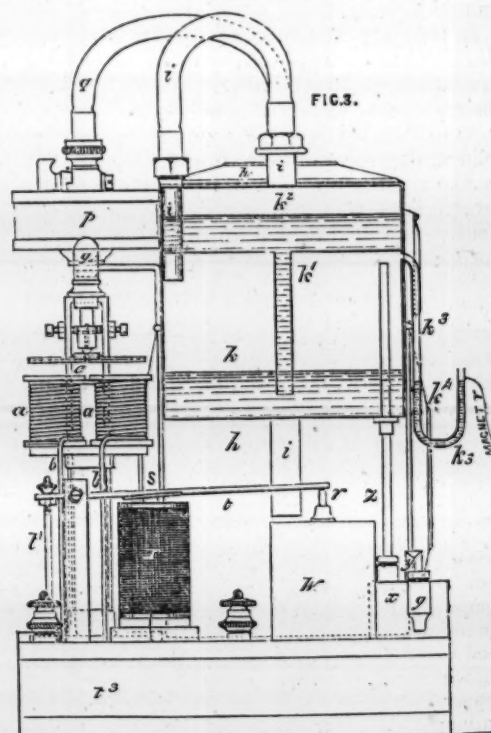
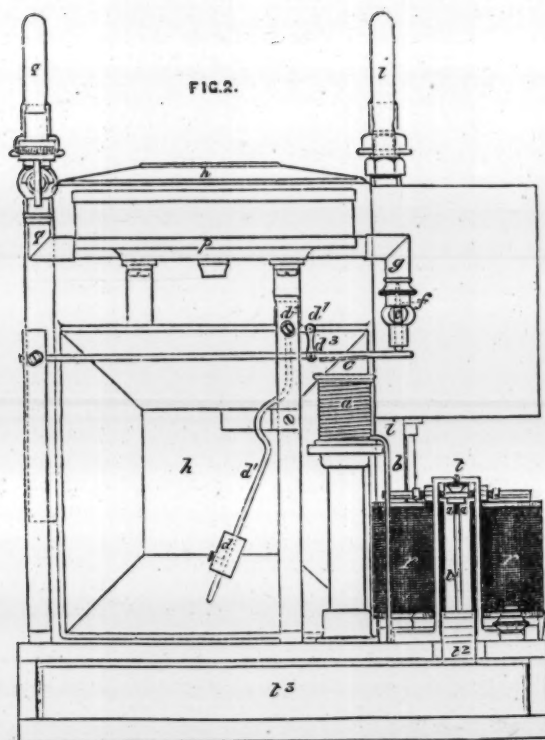
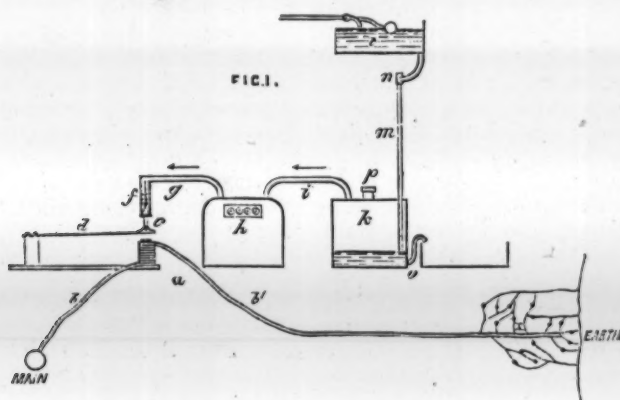
(To be continued.)

FOX'S ELECTRIC CURRENT METER.

THE principle of this apparatus, the invention of Mr. St. George Lane Fox, is shown by fig. 1. *a* is an electro-magnet, the coil of which forms part of the circuit of the conductor *b*; the amount of electricity passing through which for the supply of say a house at *x* it is desired to ascertain. *c* is an armature attached to a spring *d*. This armature carries a cone or wedge *e* working in an orifice *f*. This orifice leads by a pipe *g* to a meter *h*, like an ordinary gas meter, and thence by a pipe *i* to an air chamber *k*. The air in this chamber is kept constantly at a certain pressure, and this may be conveniently effected by means of a water air pump, as shown, that is to say, water from a reservoir *l* in descending by the pipe *m* draws in air by the inlet *n*, and carries it with it into the chamber *k*; *o* is the water outlet pipe; *p* is a valve to the chamber *k*, which valve opens when the pressure increases beyond a certain point. Thus the meter *h* has on one side a constant pressure, and on the other side an outlet at *f*, whose extent depends upon the position of the cone *e*, and, therefore, upon the distance of the armature *c* from the magnet *a*. As has been before explained, when no current is passing, the cone *e* closes the orifice *f*, and when a current of a greater or less strength is passing, the orifice *f* is opened to a corresponding extent, and consequently air, to a like corresponding extent, flows through the meter *h*. Figs. 2 and 3 represent in front and side elevations respectively (fig. 3 being partly in section), the actual form of the apparatus in which the air-chamber is kept charged by means of an electric air-pump, and in which a governor is interposed between the meter and the outlet valve or orifice. In figs. 3 and 4, *a* is the electro-magnet, whose coil forms part of the conductor *b*, the amount of electricity passed through which it is desired to ascertain. *c* is the armature fitted with a weight *d*. This weight is carried on one arm of a bell-crank *d*¹, *d*¹, centred at *d*², and the other arm of the bell-crank is connected by a link *d*³ to the armature. *c* is the cone or valve, which may either be attached

to the armature or simply rest thereon. f is the orifice in which the valve or cone e works. This orifice leads by a pipe g to a governor p , which is of the form known as a double dry gas governor, thence by a pipe q to the meter h , and from the meter by a pipe i to an air-chamber k . This air-chamber is kept charged by means of an electric air-pump, and this is effected as follows:— r is an electro-magnet, and s its armature, which is carried

of the mercury in the vessel x , as above stated, drives a corresponding volume of air up the pipe s to the air-chamber, and the return of air from the chamber is prevented by a suitable valve fitted in the pipe s . When the armature s ceases to be attracted by the magnet, the mercury, which has been previously forced from the vessel w to the vessel x returns, air entering the vessel x by the pipe y , which has a valve opening inwards, and the plunger



by a lever t centred at u . When the armature s is attracted by the magnet, the outer end of the lever t presses upon and pushes down a rod v , which is attached to a plunger in a mercury vessel w , the result of which movement is, that the mercury is forced up in a vessel x , which is in communication with the vessel w . This vessel x is closed, except to an air inlet pipe y , and to an outlet pipe s , which communicates with the air-chamber k . The rising

in the vessel w therefore rises and lifts the armature s until it is again attracted by its magnet; a pumping action is thus kept up. Instead of having mercury in the vessel w , and a plunger to act upon it, the vessel w may simply contain air, and the rod v be made to act upon a flexible diaphragm in the vessel, so as to compress the air below such diaphragm, and the rod v is, in this case, lifted by a suitable spring. The air chamber k contains a

given quantity of paraffin oil, or other suitable liquid, into which a pipe k^1 , from an upper chamber k^2 , dips, so that, as the air is more or less compressed in the chamber k , the liquid is more or less forced up the pipe k^1 into the chamber k^2 , which has an aperture at the top for the admission and exit of air as necessary. In order to break the contact when the pressure in the chamber k reaches a certain point, a syphon k^3 , made of metal, but with a glass piece k^4 interposed, is fitted to this chamber. The bend of the syphon contains mercury at such a level, that it makes contact between the two metal portions of the syphon, except when the pressure is sufficient to force its level down into the glass portion k^4 ; the contact is then broken. The manner in which contact is alternately made and broken, so as to enable the magnet r to alternately attract and free its armature s , and thus effect the pumping action before explained, is as follows:—From the tail of the lever t is suspended by a rod t^1 a plate, or piece of lead t^2 , which dips in sulphuric acid or other liquid in a trough t^3 . The contact of the lead t^2 , with the liquid in the trough t^3 , completes the electric circuit, in which are the coils of the magnet r , so that the armature is attracted. As the armature descends, the lead t^2 is gradually lifted out of the liquid, and, as soon as it is quite out of contact, the circuit is broken.

Notes.

THE INTERNATIONAL TELEGRAPH DELEGATES.—The delegates despite the unseasonable weather, are still diversifying their business with sight-seeing and entertainments. On Saturday, July 12th, they were shewn over the West India Docks, by invitation of the East and West India Dock Company. The ships were dressed in their honour, and luncheon was served in one of the large wool warehouses. On Friday, July 18th, the delegates paid a visit to the Camp at Wimbledon, where they were entertained at lunch in the Refreshment Pavilion, by the Joint Reception-Committee of the Post Office and Telegraph Companies. And on the following Wednesday, they went to Liverpool, and were entertained at a banquet given by the Lord Mayor, and a luncheon on board one of the Inman steamers. From Liverpool they then proceeded to Edinburgh and Glasgow.

FOREIGN PROGRESS OF THE ELECTRIC LIGHT.—Werdermann's system has, we believe, been adopted in the Parc d'Acclimatation at Bordeaux, and some day, perhaps, we shall see our own Zoological Gardens lit by the electric light. Jablockhoff's has been installed in the Place Schilles at Vienna. Two electric lights, fed by a Gramme machine, have also been fitted up in the famous Slate Quarries of Angers. The principal gallery of this excavation is 100 metres long by 60 metres high, and from 15 to 30 metres wide. The darkness is profound owing to the unreflective nature of the slaty walls, but the two electric lamps in question, now render the gloomy pit almost as light as noon, day and night. A light sustained by 60 Bunsen cells is to be tried on board the Giffard captive balloon, during its night ascents from the Tuileries.

The Brush Electric Light has been introduced into the mule and spinning rooms of the Willimantic Linen Company's Works at Cleveland, Ohio. A No. 5

machine, costing 1200 dollars, is used. It gives six lights of 2000 candle power each, four of which are in the mule and two in the spooling room. In the former room 60 and in the latter room 76 gas jets are displaced.

EDISON'S LIGHT.—Mr. Edison is stated to have partially overcome the obstacle to his electric light offered by the high price of platinum. His lamps, instead of costing several dollars each, as at first, can now be made of an alloy of platinum with inferior metals, so as to cost only 56 cents. He announces that he can now produce the spiral coil for incandescence at a price which all who use gas can easily afford, and that his efforts to find platinum are only induced by the desire to reduce the cost of burners still further. Mr. Edison has been so quiet of late that we have not given up all hopes of his ultimate success.

The Electric Lighting Company has failed.

THE TELEPHONE.—A number of new telephone stations have recently been opened in Germany. In Brazil, also, many plantations and business houses have been fitted up with it, and Gower's form, as constructed by Messrs. Breguet and Rodde, has been adopted by the Count d'Eu, commander of the military forces of that country.

M. Bramão, telegraph engineer of Lisbon, and better known as the inventor of Bramão's telegraph, which we illustrated on April 1, has devised a new telephone which is said to surpass most of those in vogue, the reproduced speech being heard at a distance of twenty metres from the receiver. It requires no call but the voice.

EDISON'S TELEPHONE.—A company to work this ingenious invention has been incorporated under the name of "The Edison Telephone Company, Limited." It is to continue for twenty years, the capital being 100,000 dollars divided into 1,000 shares. They also purpose to buy and use other telephonic apparatus in Europe and elsewhere. This telephone was publicly exhibited for the first time in America at the closing Spring meeting of the Franklin Institute, on June 18. The *Philadelphia Times* states that whistling, speaking, and cornet playing was heard as if only a partition full of holes or cracks intervened between the audience and performers. On June 1, a concert was also held between Sacramento and Red Bluff (Cal.), 135 miles distant, with this apparatus. The English instrument has not been exhibited lately, owing, we believe, to a lack of prepared chalk, only one cylinder having been brought over from America. While upon this subject we may mention that Mr. E. H. Johnston, the able assistant of Mr. Edison, has come over from America as Edison's European representative.

THE TELEPHONOGRAPH of M. Lagriffe is said to be an experimental success. It consists of a telephone circuit which transmits speech with a force sufficient to impress it on an improved phonograph, which repeats it if desired. We are not told whether or not loud speaking is obtained by this arrangement.

COWPER'S TELEGRAPHIC PEN.—In commenting upon the claim set up by Professor Dolbear for privacy and invention of this apparatus, the *Journal Telegraphique*, after referring to our repudiation of that claim, cites the fact that M. Hasler had published in the October number of that journal a description of a system called the *pantographe électrique*, which contains the principle of Mr. Cowper's invention, that is to say, the reproduction at a distance of characters by means of a pen

whose movements are ruled by the rectangular co-ordinates of each point in the design to be transmitted. The *Journal Telegraphique*, however, very agreeably observes that "despite the evident identity of the principle adopted by Mr. Cowper and M. Hasler, we have not received from the latter any claim of priority of invention, and our only aim in mentioning the fact here is to show how difficult it is in a new invention to avoid clashing with an old idea."

THE HUGHES INDUCTION BALANCE.—A complete induction balance has now been installed at the Royal Mint, and Mr. Chandler Roberts is sedulously engaged in testing its capacities for physical assaying. His results will be communicated to the British Association in August. On another page we give his recent note, read before the Physical Society, on the examination of tin-lead, silver-gold, and copper-tin alloys. Mr. Grove, the authorised maker of the balance has a number of orders on hand for home and foreign universities, and several of the delegates, including Dr. Brunner von Wattenwyl, are going to take instruments home with them.

JUSTICE TO MR. PRESCOTT.—In a recent number we took Mr. Prescott somewhat severely to task for, as we believed, publishing his reply to our criticism of his most recent work, *The Speaking Telephone*, without also giving the critique in question, as well as the critic's response to it. We are glad to learn, however, from the American *Journal of the Telegraph*, in which his reply was republished, that Mr. Prescott himself was not responsible for its appearance there. The *Journal of the Telegraph* says: "Whatever impropriety or injustice there may have been in omitting the criticism, we would say, in justice to Mr. Prescott, he is not responsible for it. The publication was made by the editor without any suggestion from him, and without any knowledge, other than that of any reader, of the manner in which it was to be made, until after the paper was printed." The editor adds that Mr. Prescott is not responsible for anything that appears in that organ except those articles signed by him. This statement of Mr. Ashley will correct a notion which is very prevalent here.

We have received the *Journal of the Telegraph Electrical Society* of Melbourne. It is chiefly taken up with papers and paragraphs on the electric light, the first being an introduction to the subject by Mr. L. S. Daniel, the hon. secretary and treasurer.

THE Telegraph Construction and Maintenance Company's ship *Calabria* has sailed for the Cape with the Mozambique-Zanzibar section. The steamer *Scotia* has also sailed with a portion of the new Australian duplicate cable of the Eastern Extension Company, and on July 22 she had reached Aden.

"WIRED LOVE," a romance of Dots and Dashes, is the title of a small telegraphic novel by Miss Thayer, an American female operator. It is brightly written, and shows some power of sketching.

THE *Operator* states that Rutgers' College has conferred the honorary degree of Ph. D. on Mr. Edison.

THE same journal hears that a compromise is likely to be effected between the American Bell Telephone Company and the Gold and Stock Telegraph Company.

A NEW automatic type-printing telegraph has been invented by Prof. R. E. House, of Binghamton, N. Y. It is called the House Postal Telegraph, because of its being peculiarly adapted for postal work. The message

is punched, or rather, "slit" out on a tape of paper, which is put into the sending instrument and reproduced in the receiving instrument; but this copy of the original tape is then inserted into a third instrument, which prints the message in Roman letters ready for delivery.

THE Japanese government intend to connect the Loochoo Islands with Kagoshima, Japan, by a submarine cable.

THE CANADIAN MARITIME TELEGRAPH.—The contract for the construction of the new shore line in the maritime provinces to connect lighthouses on prominent points with the telegraph system of Canada, in aid of which the Canadian Parliament last session voted a bonus of 20,000 dols., has been awarded to the Dominion Telegraph Company. The construction of this line is the first step toward the completion of the scheme for connecting the Island of Anticosta and Magdalen Islands with the shores of the St. Lawrence by telegraphic communications, and for which purpose Parliament has voted a subsidy of 15,000 dols., to be continued annually. This system has been inaugurated by the government with a view to rendering timely assistance to vessels in distress, thereby lessening loss of life and destruction of property.

THE Russian Special Telegraphic Commission has recommended a large extension of lines throughout the Empire in three classes. The first class, 21,340 versts and 410 stations, to be finished in five years, at an outlay of 840,000 roubles yearly; the second class, 16,485 versts and 129 stations, costing 2,260,820 roubles; and the third class, 12,822 versts and 90 stations, at an outlay of 4,853,950 roubles, for completion as found practicable. These lines are very distant, little used, but important for the Government.

THE ELECTRO-MOTIVE FORCE OF MERCURY ALLOYS.—Mr. Hockin and Mr. Herbert A. Taylor have been engaged in a long series of experiments suggested by the curious, but well-known fact, that the amalgamation of a zinc plate generally renders the zinc more electro-positive than it was before amalgamation, while at the same time it protects the plate to a great extent from the action of dilute sulphuric acid. Their results show that potassium, sodium, cadmium, tin, and copper, are rendered more electro-negative by amalgamation. Lead and the other electro-negative metals are little altered. Iron and zinc are rendered distinctly more electro-positive in dilute sulphuric acid. In zinc sulphate zinc is not altered by amalgamation. The authors conclude that, within narrow limits, mercury alloyed with any number of metals takes the place in the scale of electro-motive force of the most electro-positive metal that it may contain, if the amount of the electro-positive metal present is not less than about $\frac{1}{1000000}$ th in weight of the mercury. This seems explained by the facility with which a mercury surface becomes polarised, and the tenacity with which it retains the hydrogen. Also, if any zinc or other impurity exists on a portion of the surface of a mass of mercury exposed to an electrolyte, the whole service will fall to the potential of the zinc or other the most electro-positive impurity present. These laborious and important experiments of Messrs. Hockin and Taylor, are fully published in an original communication in the last number of the *Journal of the Society of Telegraph Engineers*.

AN ELECTRIC STONE DRESSER.—Mr. J. G. Cranston, engineer, of Newcastle-on-Tyne, has invented a machine which is worked by a dynamo-electric machine, and which he claims will dress millstones or other

stone, and drill rock economically, with rapidity, precision, and despatch. The chisel employed is fastened to a spring arm, which protrudes from a case containing magnets and armatures. This spring arm, when the magnets are connected with the dynamo-electric machine, moves up and down with extreme rapidity, causing the chisel to strike a blow at each descent. The inventor states that it can be made to strike from one to two thousand blows per minute. Wires being used in place of steam pipes, enable the apparatus to be moved readier to any angle, or worked at any reasonable distance without much loss of power; while not the least meritorious portion of the whole invention is the horizontal frame or base to which the electric apparatus is fixed. This frame is portable, and by the use of screws can be so adjusted as to cause the chisel to strike any portion of a circle with either a swift or slow motion, the number or intensity of the blows being regulated according to the softness or hardness of the stone. By the use of this machine, Mr. Cranston claims that he can cover a millstone in a very short space of time with the necessary grooves and furrows, having the straightness, regularity, and parallelism so much desired in good millstone dressing. The apparatus can be worked either automatically or by hand, so as to suit the varying natures of the stone being operated upon.

New Patents—1879.

2674. "Improvements in signalling apparatus and in the arrangement of circuits to be employed in connection with telephones." S. PITT (communicated by L. Anders). Dated July 2.

2697. "Indicating railway stations in the carriage by means of electricity, the apparatus being worked from the guard's van, or rendered self-acting upon the train entering the station." F. M. ROGERS. Dated July 3.

2744. "Improvements in the construction and action of electric lamps or lights, or mechanism connected therewith." G. WHYTE. Dated July 5.

2769. "Improved means and apparatus for electric lighting." H. E. NEWTON (communicated by H. W. Cook). Dated July 7.

2821. "Improvements in and relating to apparatus for automatically opening and closing electrical circuits, chiefly designed for use in the electro-deposition of metals." G. ZANNI. Dated July 10.

2878. "Manufacture of magnetic stays, corsets, bodices, and other female and male garments for the relief and cure of disease." W. WILSON. Dated July 15.

2905. "Electrical apparatus for medical and other purposes." C. H. CARLSON. Dated July 16.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.—1878.

4041. "Electro-magnetic engine for driving rotary hair brushes." W. North. Dated Oct. 12. 2d. An armature frame is caused to revolve by making and breaking inducing magnets. (*Not proceeded with.*)

4043. "Applying electricity for lighting and heating." St. G. Lane Fox. Dated Oct. 12. 6d. This describes a plan for retaining the heat on the platinum electro-pyres or electric burners by coating the surface with some thermal non-conducting material such as asbestos, fire-clay, lime, steatite, or some vitreous material. Asbestos platinised or saturated with conducting material is also used. A fine coil of wire of platinum, &c., may also be used for the light emitter, either bare or coated with

the above materials. A regulator for the current is provided by means of a copper or silver rod plunged into mercury, and enclosed in a glass vessel. The rod dips into the mercury less or more according to the strength of the current, thereby inserting more or less resistance in circuit.

4046. "Obtaining electric light." G. P. HARDING. Dated Oct. 12. 2d. This describes an idea for pushing forward electrodes by means of the buoyant power of liquids. (*Not proceeded with.*)

4047. "Apparatus for regulating electric light." G. P. HARDING. Dated Oct. 12. 6d. This describes a current regulator formed of a metal wire arranged to expand and contract by heat due to the current, so as to throw in or take out of circuit a shunt which carries away a portion of the current from the burner.

4066. "Magneto-dynamo electric machines." J. IMRAY. Dated Oct. 14. 6d. In a suitable framing two flat discs of copper are fixed at some distance apart with projecting electro-magnets set round. Between is rotated two smaller discs of copper carrying armature bobbins set round. The inner or revolving magnets are equal in number to the outer inducing ones. In order to reduce the force necessary to separate the poles of the revolving magnets from those of the stationary ones, it is of advantage to use half the number of the former and to fix them obliquely, so that while one pole of each is facing a pole of one of the stationary magnets, the other pole of the former is facing the opposite pole of the stationary magnet next in order. Instead of winding each armature core separately, a bundle of the insulated wires may be wound in a zig-zag manner over one notch of each core, and thence over the opposite notch of the next, and so on round the whole circumference so as to include all the cores in one circuit.

4074. "Indefinitely dividing electric currents." ANTOINE ARNAUD. Dated Oct. 14. 2d. This consists in arranging the circuit so as to obtain uniformity in all parts. Both conductors are connected to the positive pole, one directly as usual, the other through the work to be done by each section of the circuit. The current then follows a parallel course in the two conductors, passing from the first to the second by the work to be done, and thence along the second to the end of the circuit before returning to the negative pole.

4075. "Galvanic batteries." J. H. JOHNSTON (communicated by W. W. Griscoin, New York). Dated Oct. 14. 8d. This describes a box battery, which permits the exciting liquid to flow through the cells intermittently or continuously from suitable reservoirs.

4094. "Producing and regulating electric currents." J. L. PULVERMACHER. Dated October 15. 8d. This describes improvements on the batteries of the author (*see patent No. 3469, of 1877*), and in the construction of electro-motor engines, metallic hair-brushes, and the employment of a magnetic balance in timekeepers.

4095. "Galvanic batteries." F. H. W. HIGGINS. Dated October 15. 2d. On account of the liability of most of the common metals to oxidise at the surface in connection with carbon in moist places, the connection is faced with a thin washer of platinum-iridium, soldered on one side of the nut which screws on the wire from the zinc plate; this wire passes through a hole in the carbon, and the ring is pressed against the carbon plate by the tightening nut. (*Not proceeded with.*)

4114. "Dividing and distributing electric currents for lighting, &c." E. J. C. WELCH. Dated Oct. 16. 2d. A number of circuits are fed consecutively with electricity by means of a rotating contact. (*Void.*)

4140. "Electrical apparatus." W. SCOTT. Dated October 18. 2d. This describes a contrivance for distributing electric currents. It consists of a compound

bar made of metals which expand by different degrees when heated. The bar is bent in the form of a helix, and fixed at one end, while the other is attached to an arm. The current is passed through the bar, and, by heating it, works the arm. This arm is fitted with sliding contacts, which vary the resistance in two or more rheostats. One of the rheostats is connected with a branch circuit which passes through the compound bar, and thus expanding it by change of temperature, increases the resistance it meets with by the movement of the arm, and is thus retarded, so at the same time the current on the main wire from the generator by the same movement may pass in increased quantity by the reduction of the other rheostat resistance. Thus the current is automatically controlled.

4161. "Commutator for submarine telegraphy." E. EDMONDS. Dated Oct. 18. 2d. A communication from Count Siccardi, Turin. This describes a new arrangement of the keys illustrated in patent No. 275, 1878. (*Not proceeded with.*)

4163. "Electric lighting." J. N. ARONSON, H. B. FARNIE. Dated October 18. 4d. This describes the use of ruthenium, osmium, and rhodium, as an imperishable substitute for carbon. The metals singly, or alloyed, or mixed with plaster of Paris, &c., may be used as points, or else rendered incandescent by passage of the current through them.

4202. "Application of electricity to pneumatic apparatus for sounding bells." Dated October 22. 4d. The author proposes to combine battery or magneto-electric machine with the keyboard of a console and a pneumatic arrangement in connection with the strikers or bell hammers, whereby the pneumatic apparatus may be placed in the most convenient position contiguous to the bells, and to actuate it from a console placed at any distance therefrom. (*Not proceeded with.*)

4206. "Magneto or dynamo-magneto electric machines." R. P. HIGGS. Dated October 22. 2d. The conductor and magnet of this machine are caused to rotate as a solid body, instead of the magnets remaining fixed and the conductor rotating. (*Not proceeded with.*)

4210. "Speaking telephones." J. F. BAILEY, New York. Dated October 22. 6d. This describes a telephone similar to Phelps' "Crown" form.

4212. "Lighting by electricity." C. T. BRIGHT. Dated Oct. 22. 2d. The main current is passed through an induction coil primary; and the secondaries are connected to the lamps, which consist of glass vessels filled with rare gases, such as nitrogen, or vapours of phosphorous, mercury, ether, or volatile hydro-carbons.

4226. "Developing electric currents, and lighting by electricity." T. A. EDISON. Dated Oct. 23. 1s. This describes the tuning fork generator of Edison.

4240. "Electric telegraph apparatus." W. R. LAKE (a communication from F. Tommasi, Paris). Dated Oct. 23. 6d. This describes Tommasi's sensitive relay, in which a very small magnetic bar is placed between two powerful electro-magnetic poles. The bar acts as the relay tongue.

4278. "Apparatus for electric lighting." E. J. C. WELCH. Dated Oct. 25. 6d. This describes a distributor formed of two series of contact pieces, one fixed the other rotary. These split up the current amongst a number of separate currents consecutively.

4304. "Dividing and distributing the current produced by galvanic batteries." C. E. SHEA. Dated Oct. 29. 6d. This describes a plan for dividing a current among several circuits by a rotating contact, which passes rapidly across the ends of these circuits. (*Not proceeded with.*)

4313. "Obtaining and applying electricity." A. A. COCHRANE. Dated Oct. 26. 2d. This describes a

plan for generating electricity from evaporation of liquids, and storing it in Leyden jars for electric lighting, or other purposes. (*Not proceeded with.*)

4315. "Apparatus for producing light by electricity." B. P. STOCKMAN. Dated Oct. 26. 2d. This consists in keeping carbons together by floating them in mercury or other liquids. It may be applied to parallel candles. (*Not proceeded with.*)

4316. "Electrical arrangements." J. W. CADETT. Dated Oct. 26. 6d. This describes a means of obtaining increased electric force by condensers joined up in series. The charge in the condensers is regulated by resistance inserted by an automatic electro-magnet.

4317. "Lamps for lighting by electricity." F. D. TILLEARD. Dated Oct. 26. 2d. This describes a metal lamp case for the electric light in travelling carriages. (*Not proceeded with.*)

4338. "Obtaining light by electricity." C. W. HARRISON. Dated Oct. 28. 2d. This consists in using fluid conductors for electro-pyres, or electric light burners, and interrupting their continuity by a vibratory or other movement so as to give a succession of sparks or flashes sufficiently rapid to produce a continuous light. Mercury is used as the conductor and the vapours are suitably condensed. (*Not proceeded with.*)

4344. "Gas batteries for the production of electricity." F. J. ODLING. Dated Oct. 29. 2d. Two extended surfaces of carbon are separated by an acid or saline solution. One is exposed to hydrogen, and the other to air. Electricity is generated by the reaction of the H and the O of the air, and led from the carbons by conductors. (*Not proceeded with.*)

4346. "Manufacture of telegraph cables." E. BERTHOULD, F. BOREL. Dated Oct. 29. 6d. This consists in forming submarine cables by drawing out a primitive ingot composed of the core and sheathing to any required length. The whole is encased in a soft metal tube such as lead, the insulator may be resin, powdered glass, or sulphur.

4347. "Apparatus for producing electric light." J. S. WILSON. Dated October 29. 6d. This describes an electric lamp in which two carbon electrodes are kept together by a spring, controlled by electro-magnetism.

4348. "Secondary galvanic batteries." J. S. WILSON. Dated October 29. 2d. The plates of this battery are of iron, and the liquid is a solution of nitrate of soda, mixed with a saturated solution of sulphate of soda, the acid of which makes a soluble salt with iron. (*Not proceeded with.*)

4367. "Telephones." J. F. BAILEY, New York. Dated October 29. 6d. This describes a carbon telephone similar to Mr. Edison's.

4388. "Producing electric light." S. F. VAN CHOATE. Dated October 31. 4d. This describes electro-pyres of asbestos, mica, platinum, carbon, or combinations of these. The electro-pyres are made in bands, balls, discs, &c. (*Not proceeded with.*)

4407. "Applying electricity as a source of heat." A. M. CLARKE (communicated by C. Davis, Paris). Dated October 31. 2d. Heat is obtained by the passage of a current through platinum conductors or from the sparks of an induction coil.

4438. "Preparing gutta-percha for insulating telegraphic conductors." E. T. TRUMAN. Dated November 2. 4d. This consists in preparing it without mastication, which is injurious. In this improved process the gutta-percha is reduced to a spongy, porous mass, during the cleansing operation, and then twisted by a special machine. This twisting expels the air from the pores without injuriously kneading or disturbing the natural grain of the gum.

City Notes.

Old Broad Street, July 29th, 1879.

ANGLO-AMERICAN TELEGRAPH COMPANY (Limited).—In anticipation of the meeting of this Company the report has been issued. It says: "With £3,587 brought forward, the total receipts of the half-year were £298,393, showing an increase of £25,120 compared with the corresponding period of last year, while the expenses were £54,592. The sum of £75,000 has been added to the renewal fund, and a quarterly dividend of 2 per cent. on the Preferred, and at the rate of 4 per cent. per annum on the ordinary stock has been paid. A second quarterly dividend of $2\frac{1}{2}$ per cent. on the former, and at the rate of 5 per cent. on the latter stock, will be paid on the 1st proximo, leaving £11,300 to be carried forward. In view of the approaching competition of the new French Company, and to facilitate the increased number of messages expected from a lower tariff, it has been determined to lay a new cable next year, for which the shore ends and part of the intermediate types of the 1865 and 1866 cables will be available; while the deep sea section, which will be of the latest improved type, will be paid for out of the renewal fund. The duplex system of telegraphy, invented by Mr. J. B. Stearns, and applied to the cable laid in 1874, has been taken over by the Company as from the 1st March, 1879. The royalty to be paid to Mr. Stearns during the life of his patents, for their use upon the whole of the Company's system, amounts at present to £1,300 per annum, the maximum payment being limited to £1,500 per annum. The system will be gradually extended to the whole of the Company's cables."

DIRECT UNITED STATES CABLE COMPANY.—The report of this Company, to be presented at the fourth ordinary general meeting, to be held at the City Terminus Hotel, on August 1st, says: "With this report the directors, submit the usual statements of account for the half-year ending 30th June, 1879, which, with the half-year's accounts to the 31st December last, presented at the ordinary general meeting on the 21st March last, show the financial result of the second year's working of the Company. For the half-year the revenue, after deducting outpayments, amounted to £87,706 3s. 2d.; for the corresponding period of 1878 the amount of revenue, after similar deductions, was £79,852 11s. 5d. The working and other expenses (exclusive of cost of repairs), interest on loan, and income tax, &c., amounted for the half-year to £20,523 5s. 10d., leaving a balance of £67,182 17s. 4d. as the net profit for the half-year; making, with £5,273 8s. 4d. brought forward from the previous half-years, a total of £72,456 5s. 8d. In the corresponding half-year of 1878 the expenses and payments above mentioned (also exclusive of cost of repairs), amounted to £20,065 17s. 9d. The cost of repairs for the half-year, amounting to £8,965 9s. 11d., has been paid for out of, and is charged against the reserve fund. Three quarterly *interim* dividends of $1\frac{1}{2}$ per cent. each, amounting to £45,532 10s. 0d., have been declared and paid at the usual times during the financial year, and a final dividend of 5s. per share is now proposed, making, with the three *interim* dividends, 5 per cent. for the year, being a total distribution of £60,710. The appropriation of the above balance of £72,456 5s. 8d. on the revenue account is thus shown:—*Interim* dividend for quarter ending 31st March last, £15,177 10s.; final dividend now proposed, £15,177 10s.; carried to reserve fund, thereby increasing it to £100,000—£34,756 4s. 3d.; written off preliminary and arbitration expenses, £5,000; carried forward to next account,

£2,345 1s. 5d.; total, £72,456 5s. 8d. The agreement with the Dominion Telegraph Company of Canada, referred to in the last report, has been completed, and came into operation as from the 1st January, 1879. The break in the Company's main cable, which occurred on the 4th January last, was repaired on the 20th March, and the interruption on the 12th February last, of the short section, was repaired on the 22nd April. Both sections of the cable are in good working order.

THE INDIA-RUBBER, GUTTA-PERCHA, AND TELEGRAPHS WORKS COMPANY (Limited).—It is announced that, after deducting the usual depreciation on buildings and machinery, the net profit made by this Company, in the six months ending 30th ultimo, is, subject to audit, £18,800. Of this sum the directors propose to distribute an *interim* dividend for the half-year of 10s. per share, being at the rate of 10 per cent. per annum, leaving £3,200 to be added to the £9,049 brought forward on December 31st last, and making the balance now to be carried forward £12,249.

THE EASTERN TELEGRAPH COMPANY (Limited).—At the fourteenth ordinary general meeting of this company, held on July 14th, the chairman, having moved the adoption of the report, an abstract of which appeared in our last issue, and the same having been seconded by the Marquis of Tweeddale, said in answer to questions by shareholders: Is there any other question to be put? Well, then, I may say to Mr. Newton, in the first place, that I think we have shown you that there is an increase in the stations alone of 12 stations, and I think that the gross increase that we shew you is £6,000 odd. Then there is — Mr. Newton: £6,160 in the half year; that means £12,320 per annum. The Chairman: Yes; quite true. Well, if you take 12 stations, and take them at an average of £500, you have £6,000 to begin with, and if you take the loss of £7,000 on exchange you have the net amount without any difficulty. As to fluctuations in the exchange it is very difficult for me to give an opinion. The wisest men at the present moment are baffled by this question of silver, and if there is any hon. gentleman who can throw any light on the subject I am sure that it will not only be acceptable to me and the Board generally, but also acceptable to a great many others who are deeply interested in the trade; but I may mention to you that we have not been idle and have not been thoughtless on this particular question, and we have entered into an arrangement now with the Indian Government which will give more favourable terms to the company as regards the value of the rupee. Mr. Newton: That leads me to another question. Have you some arrangement with the Government that they take any risk of the fluctuations in the price of silver and in the value of the rupee? As I understand it you collect your revenue in Calcutta in rupees. We cannot take any benefit from the Government in that respect; we must take the chance if the exchange is 1s. 6d. And I do not think that we ought to consider that we make a loss on exchange unless you, for convenience in the accounts, take the value, say at 20d., which is 1s. 8d. in our money, but received abroad in the rupee. We certainly must take the risk of it being remitted home, like any merchant, unless the Government is so kind as to give us an increase on the value to that prevailing in the markets abroad. That is what I mean—not that we take any benefit from anyone, but that we take our chance like any merchant. The Chairman: I think that if you asked any merchant who sends out goods to Calcutta he will tell you that it is a question of the exchanges where he makes a loss where otherwise he expected a profit. But the Indian Government forms part of our joint purse; and in future we have arranged with the Government that it is to be taken at about 1s. 7½d.,

and, therefore, any variation below that must be to our detriment; but above it, as it is now, it is in our favour. Now, gentlemen, I think those are the only two questions I have been asked, and I hope that I have answered them satisfactorily. The resolution for the adoption of the report was then put to the meeting and carried unanimously. The question of the Cape cable was then discussed at considerable length, Mr. Newton remarking on the want of a limit to the increase of preference and debenture capital when compared with the ordinary capital of the Company. He also said, "Seeing the tremendous influence of our directors, I am amazed that, as to that part of which so much is made, the influence of the directors with the Government has not produced us a better bargain; and it would seem that the influence is not worth so much, seeing the results of this new undertaking; and the sooner you get on your board two or three more gentlemen of consummate mercantile capacity (hear, hear), the better will it be not only for you, sir, and your Company, but for every member of telegraph property." The chairman then proposed the following resolution:—"Resolved, that the several provisional agreements referred to in the directors' report, and submitted to this meeting with the Lords Commissioners of Her Majesty's Treasury, the Colonial Governments of the Cape of Good Hope and Natal, the Portuguese Government, and the Sultan of Zanzibar, with respect to a line of submarine telegraph between this Company's station at Aden and Natal, and the arrangements mentioned in the report as to the making, laying, and working of the cables, be and the same are hereby approved and adopted so far as the same relate to the matters and things to be done by this Company, and that the board of directors be and they are hereby authorised on behalf of this Company to complete and carry into effect the said agreements and arrangements, with or without any modifications or alterations from time to time required or approved by the board; and also to make and carry into effect any other agreements and arrangements with reference to the said cables which the board may think desirable; and also to subscribe for and accept on behalf of the Company shares and debentures of the proposed Eastern and South African Telegraph Company; and to raise, by the issue of debentures of this Company or otherwise, such moneys as may be required for those purposes or any of them, and apply the same accordingly as the board shall from time to time deem expedient." Sir James Anderson seconded it, and, after some further critical remarks by Mr. Newton, it was put to

the meeting, and carried with one dissentient. The usual vote of thanks then brought the proceedings to a close.

The Eastern Extension Telegraph Company (Limited) notify that the Six per Cent. Debentures, due on August 1st, will be paid on or after that date, on presentation at the Consolidated Bank.

The Eastern Extension Telegraph Company (Limited) notify that their Java-Darwin cable is now repaired, thus restoring direct telegraphic communication with Australia and New Zealand.

The *Faraday*, steam screw cable ship, has returned to Messrs. Siemens Brothers' Telegraph Works, Charlton, after having successfully laid 200 miles of the shore end of the new French Atlantic cable in course of being laid down from St. Pierre to the United States. The *Faraday* will shortly begin to take on board the first portion (about 1,000 miles) of the deep sea cable, and is expected to make three voyages before France and America are placed in direct and independent communication.

The following are the final quotations of telegraphs:—Anglo-American, Limited, 53½-53¾; Ditto, Preferred, 82½-82¾; Ditto, Deferred, 26¼-26½; Brazilian Submarine, Limited, 6½-7½; Cuba, Limited, 7½-8½; Cuba, Limited, 10 per cent. Preference, 15½-16½; Direct Spanish, Limited, 1¼-2¼; Direct Spanish, 10 per cent. Preference, 10¼-11¼; Direct United States Cable, Limited, 1877, 10½-10¾; Eastern, Limited, 7½-7¾; Eastern, 6 per cent. Debentures repayable October, 1883, 105-108; Eastern 5 per cent. Debentures repayable August, 1878, 103-106; Eastern, 6 per cent. Preference, 11¼-12; Eastern Extension, Australasian and China Limited, 7½-8; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 108-111; German Union Telegraph and Trust, 7½-8; Globe Telegraph and Trust, Limited, 4½-5½; Globe, 6 per cent. Preference, 10½-11½; Great Northern, 8½-8¾; Indo-European, Limited, 20½-21½; Mediterranean Extension, Limited, 2½-3; Mediterranean Extension, 8 per cent. Preference, 9-9½; Reuter's, Limited, 9-10; Submarine, 229-234; Submarine Scrip, 2-2½; West Coast of America, Limited, 1-1½; West India and Panama, Limited, 1½-1¾; Ditto, 6 per cent. First Preference 7½-8½; Ditto, ditto, Second Preference, 7½-7¾; Western and Brazilian, Limited, 2½-3¼; Ditto, 6 per cent. Debentures "A," 96-100, Ditto, ditto, ditto, "B," 89-94; Western Union of U.S. 7 per cent., 1 Mortgage (Building) Bonds, 118-122; Ditto, 6 per cent. Sterling Bonds, 107-109; Telegraph Construction and Maintenance, Limited, 30-30½; Ditto, 6 per cent. Bonds, 106-108; Ditto, Second Bonus Trust Certificates, 2½-2¾; India Rubber Co., 12¼-13¼; Ditto, 6 per cent. Debenture, 106-109.

TRAFFIC RECEIPTS.

Name of Co., with amount of issued capital, exclusive of preference and debenture stocks.	Anglo- American Co. £7,000,000.	Brazilian Sub. Co. £1,300,000.	Cuba Sub. Co. £160,000.	Direct Spanish Co. £116,379.	Direct U.S. Co. £1,213,900.	Eastern Co. £3,697,000.	Eastern Ex. Co. £1,997,500.	Gt. Northern Co. £1,500,000.	Indo-Euro. Co. £425,000.	Submarine Co. £338,225.	West Coast America Co. £300,000.	Western and Brazilian Co. £1,396,200.	West India Co. £88,210.
	£	£	£	£	£	£	£	£	£	£	£	£	£
June, 1879 ...	45,000	11,021	2,400	1,025	15,000	36,635	26,485	19,618	...	10,661	...	9,379	5,057
June, 1878 ...	41,480	11,124	3,175	793	12,840	31,118	23,269	18,582	...	10,350	...	...	3,884
Increase ...	3,520	...	...	232	2,160	5,517	3,216	1,036	...	311	...	...	1,173
Decrease ...	...	103	775	...	...	...	...	...	...	...	...	...	...

(The figures in this Table are as accurate as it is in our power to make them, but we do not guarantee their correctness.)

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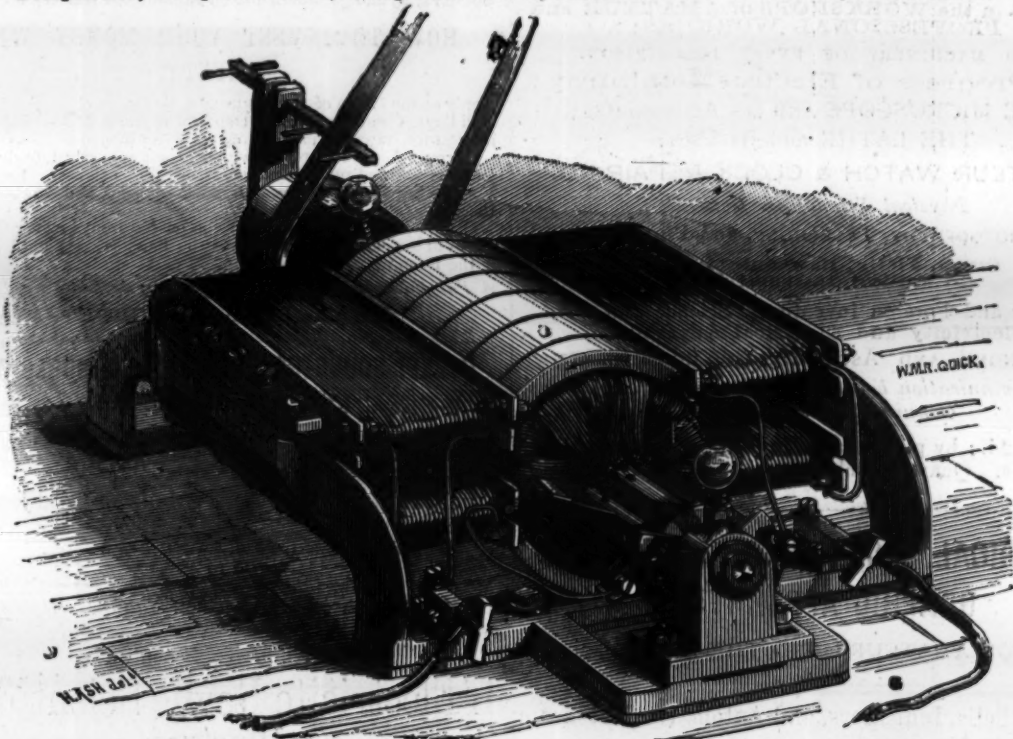
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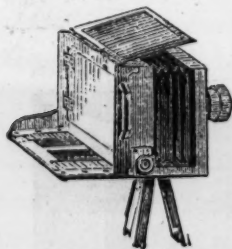
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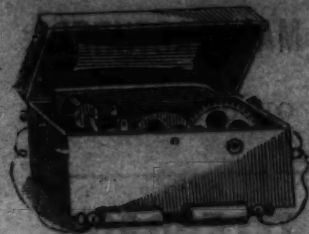
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